

PHYSICS FRONTIERS CENTERS (PFCs)

Program Solicitation

NSF 00-108

**DIRECTORATE FOR MATHEMATICAL
AND PHYSICAL SCIENCES
DIVISION OF PHYSICS**

PREPROPOSAL DEADLINE: September 18, 2000

FULL PROPOSAL DEADLINE: January 26, 2001



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SUMMARY OF PROGRAM REQUIREMENTS

GENERAL INFORMATION

Program Title: Physics Frontiers Centers (PFCs)

Synopsis of Program:

The Physics Frontiers Centers (PFCs) program supports university-based centers and large groups in cases where this mode of research is required to make transformational advances in the most promising research areas. Proposals will be considered in areas within the purview of the Division of Physics, broadly interpreted, e.g., atomic, molecular, optical, plasma, elementary particle, nuclear, astro-, gravitational, interdisciplinary, and emerging areas of physics. Interdisciplinary physics is taken here to mean research at the interface between physics and other disciplines, e.g., biophysics, quantum information science, mathematical physics. The purpose of the PFC program is to enable major advances at the intellectual frontiers of physics by providing needed resources not usually available to individual investigators or small groups. PFCs make it possible to address major challenges that require, e.g., combinations of talents, skills, and/or disciplines; specialized infrastructure; large collaborations; and centers/institutes that catalyze rapid advances on the most promising research topics. The successful PFC will demonstrate: (1) the potential for a profound advance in physics, broadly defined; a major impact on another field; or benefit to society; (2) a synergy or value-added rationale that justifies a center-like approach; and (3) creative, substantive activities aimed at enhancing education, diversity, and public outreach.

Cognizant Program Directors:

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Applicable Catalog of Federal Domestic Assistance (CFDA) Number:

- 47.049 --- Mathematical and Physical Sciences

ELIGIBILITY INFORMATION

- **Organization Limit:** Proposals may be submitted by universities and colleges in the United States. In cases involving multi-institutional consortia, a single entity must accept overall management responsibility.
- **PI Eligibility Limit:** None
- **Limit on Number of Proposals:** No more than two pre-proposals may be submitted by any one institution. Any one individual may be the Principal Investigator (PI) for only one pre-proposal. The same limitations apply to full proposals.

AWARD INFORMATION

- **Anticipated Type of Award:** Grant
- **Estimated Number of Awards:** 3-5
- **Anticipated Funding Amount:** Up to \$10M will be available for new PFC grants in FY 2001
- **Anticipated date of award:** On or about August 1, 2001

PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions: Supplemental Preparation Guidelines

- In addition to the standard GPG proposal preparation guidelines, PFC-specific guidelines apply. Additional information is supplied below.

B. Budgetary Information

- **Cost Sharing Requirements:** Cost sharing is required
- **Cost Sharing Level/Amount:** Cost sharing of 15% of the total (five year) requested amount of NSF funds is required and must be shown on line M of the budget page (NSF Form 1030).
- **Indirect (F&A) limitations:** In accordance with Federal Negotiated Rate.

- **Other Budgetary Limitations:** Five-year awards are expected to range in size between \$0.5 million/year and \$4 million/year, with an average award size of approximately \$2M/year. The budget for the full proposal may not be larger than the pre-proposal budget.

C. Deadline/Target Dates

- **Letter of Intent Deadline:** None
- **Preproposal Deadline:** 5:00 PM local time, 9/18/00
- **Full Proposal Deadline:** 5:00 PM local time, 1/26/01

D. FastLane Requirements

- **FastLane Submission:** FastLane submission required for both pre-proposal and full proposal.
- **Fast Lane Contact:** Ms. Ramona Winkelbauer, FastLane Expert, Division of Physics, phyfl@nsf.gov, 703-306-0544.

PROPOSAL REVIEW INFORMATION

- **Merit Review Criteria:** Standard National Science Board approved criteria and additional PFC-specific criteria apply. Please see the full program announcement, below, for further information.

AWARD ADMINISTRATION INFORMATION

- **Award Conditions:** Standard NSF award conditions apply.
- **Reporting Requirements:** Annual progress report and continuation request required.

I. INTRODUCTION

Physics addresses an inspiring range of phenomena, from quarks to the cosmos, from the Big Bang to the end of the universe, and all length and time scales in between. The results of physics research touch everyone's life every day and promise solutions to some of our most daunting challenges. In a very real sense, advancing the intellectual frontiers in science, generally, and physics, in particular, is vital to the nation's health, prosperity, and defense.

Major advances in physics are produced by efforts of all sizes, from the individual investigator to the large collaborations with hundreds of members. Over time, the small research group has been the most important producer of ideas and innovations, and the large collaborations of today are needed to address certain problems involving large-scale tools, e.g., particle accelerators, large-scale detectors at colliders, gravity-wave detectors, and satellite-based observatories. Within this context, an increasingly important mode of discovery-class research involves intermediate-sized collaborations that involve a mix of disciplines and/or talents, infrastructure for shared use, and center activities. It is this mode of research that the Physics Frontiers Centers program is designed to address.

The PFC program will enable university-based investigators to address research areas that require more resources than are normally available to individual investigators or small groups. PFCs make it possible to address major challenges that require, e.g., combinations of talents, skills, and/or disciplines; specialized infrastructure; large collaborations; and centers/institutes that catalyze rapid advances on the most promising research topics. The PFC program therefore complements but does not substitute for NSF support for individual investigators, small groups, national user facilities, and instrumentation.

Physics Frontiers Centers will address the most exciting questions at the very edge of current understanding. Such activities frequently take new research directions and always involve considerable technical risk. Organization of such activities will vary widely, depending on the particular needs of the research. It follows that maximum flexibility in the design of PFCs is essential. The PFC program will therefore be defined by rather general boundaries, leaving the specific organization to the creativity of the principal investigators. The PFCs will be judged by the two standard NSF criteria of intellectual merit and broader impact, plus the synergy and value added that justifies center-level support.

PFCs are expected to provide an exceptionally stimulating environment for education. Students will benefit from interactions with a large, often interdisciplinary, group of scientists at all career levels. PFCs should strongly attract the most talented and motivated graduate and undergraduate students and postdocs and provide them with broad educational experiences. They should also reach out to involve younger students and the public in ways that increase science interest and literacy.

The purpose of the PFC program is to support timely, aggressive, and forward-looking research that has the potential to lead to a major advance in physics and, thereby, to advances in other

fields and to benefits for society. Proposals will be considered in areas within the purview of the Division of Physics, broadly interpreted, e.g., atomic, molecular, optical, plasma, elementary particle, nuclear, astro-, gravitational, interdisciplinary, and emerging areas of physics. Interdisciplinary physics is taken here to mean research at the interface between physics and other disciplines, e.g., biophysics, quantum information science, mathematical physics. Research in condensed-matter physics and materials science are supported primarily by the Division of Materials Research. Proposals using experimental, theoretical, or computational methods, or any combination will be considered. PFCs will address problem(s) at the frontiers of physics and may involve more than one subdiscipline of physics as well as other disciplines of science and engineering.

II. PROGRAM DESCRIPTION

PFCs are supported to enable research at the frontiers of physics of a scope and complexity that would not be feasible with standard individual investigator or small group support. The primary purpose of the PFCs is to provide the means necessary for university researchers to form centers or large group efforts that lead to major new ideas, discoveries, or broad advances in physics or at the boundaries of physics with other disciplines. Proposals for PFCs may address any area normally in the purview of the Division of Physics, including interdisciplinary and emerging areas of research.

Proposals for PFCs will be judged according to three criteria: First, and foremost, the proposals must exhibit intellectual merit of the highest order, as evidenced by the importance of the research focus and the potential for major new ideas, discoveries, or broad advances in physics. See NSF criterion #1 in Proposal Review Information, below, for a full description of this criterion. Second, the proposal must exhibit broader impacts such as those described in NSF criterion #2, e.g., impacts on other fields, on society, education, diversity, and/or outreach. Third, the proposal must exhibit synergy or value-adding features that justify center-type support, rather than an equivalent level of support for individual investigators or small groups. Proposals must address these points for each major research component of the PFC, and the roles and responsibilities of each senior investigator must be described. Reviewers will be asked to assess each major activity and each investigator in their review.

Since PFCs represent research at the intellectual frontiers, new types of centers may be needed to address the most promising problems. Therefore, preconceived specifications are kept to a minimum. In all cases, however, a center must demonstrate that the whole is substantially greater than the sum of the parts; and there must be a management and governance plan to indicate how the PFC will operate. Such a plan must contain information on how decisions are made, the existence and makeup of any advisory board to be used, principal investigators responsible for different parts of the PFC's activities, including education, diversity, outreach activities, etc.

The main characteristics of a PFC are tailored by the principal investigators to most effectively address the chosen physics goals. Therefore, every PFC will be different. Nevertheless, it is

useful to point out some characteristics of successful centers in physics and other fields. In no particular order, these are: (1) combining talent, skills, facilities required for a major advance in physics; (2) combining groups, departments, institutions, etc. required to make a major advance; (3) providing specialized infrastructure needed for an advance by the center, and often the broader field; (4) providing the context and/or organization to bring together leaders and students to initiate work in a promising new area, a new interdisciplinary field, an important application, or a new facility of strategic importance to physics; (5) making available specialized infrastructure to others; and (6) creation of innovative projects to promote education, diversity, and public outreach using the center as a focal point.

The combination of PFC support with other support will be handled in the following way: If the existing individual support is for work not related to the PFC, it is relevant to the PFC only to the extent that existing and pending support must always be listed in a proposal. If an existing grant is related to the objectives of the proposed PFC, existing support would be considered to be a base for the incremental PFC support that would then enable the additional benefit of the PFC. If no related support exists, or if the PIs so choose, the PFC budget can include all support for the activity. Examples of both approaches exist, and the PIs are encouraged to discuss such matters with the cognizant Program Director prior to submitting the pre-proposal.

III. ELIGIBILITY INFORMATION

Academic institutions in the USA with broad research and education programs in the areas of physics outlined in the Program Description in Section II may submit pre-proposals.

In order to reduce the burden of proposal writing for the physics research community and the burden of subsequent proposal review and evaluation for reviewers and NSF staff, the NSF will accept full proposals for PFCs by invitation only, based on the results of the pre-proposal evaluation.

No more than two pre-proposals may be submitted by any one institution. While more than one institution may participate in a single proposal or pre-proposal, a single institution must accept overall management responsibility for the PFC. Any one individual may be the Principal Investigator (PI) for only one pre-proposal. The same limitations apply to full proposals

IV. AWARD INFORMATION

Individual PFC awards are expected to range in size between \$0.5 million/year and \$4 million/year, with an average award size of approximately \$2M/year. Awards will be made for five years. The number of awards in FY 2001 is expected to be in the range 3-5, depending upon the availability of funds and the quality of proposals received. In future years, renewal proposals from previously funded PFCs will be evaluated in open competition with new proposals. If a renewal proposal from a previously funded PFC is not successful, phase-out support *may be* provided at a reduced level for a period of up to two years.

Anticipated date of awards: On or about August 1, 2001.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Proposals submitted in response to this program announcement should be prepared and submitted in accordance with the general guidelines contained in the NSF *Grant Proposal Guide* (GPG) (NSF 00-2). The complete text of the GPG (including electronic forms) is available electronically on the NSF Web Site at: <http://www.nsf.gov/pubs/2000/nsf002/start.htm>. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 or by e-mail from pubs@nsf.gov.

Pre-proposal

The pre-proposal must be submitted via NSF FastLane. The pre-proposal must be single-spaced in 12-point type, and consist of:

- (1) the NSF coversheet (NSF Form 1207) showing the name of the proposed PFC director (principal investigator or PI) and the pre-proposal title. The block indicating that a pre-proposal is being submitted should be checked. It is not necessary to send in page two of NSF Form 1207 for pre-proposals.
- (2) a narrative (described at the end of this section); enter in the "Project Description" FastLane form.
- (3) a list of participating senior investigators (faculty level and equivalent) by name, institutional affiliation, and departmental affiliation (additional biographical information is *not* required in the pre-proposal); include this at the end of the narrative along with a title that clearly identifies the section and enter in the "Project Description" FastLane form.
- (4) a one-page synopsis of institutional and other commitments to the proposed PFC; include this at the end of the narrative along with a title that clearly identifies the section and enter in the "Project Description" FastLane form.
- (5) budget pages (see Budgetary Information, section V.B.), and a one-page budget justification; enter in the "Budgets" FastLane form.
- (6) a summary table of requested NSF support (see Budgetary Information, section V.B.); include this at the end of the narrative along with a title that clearly identifies the section and enter in the "Project Description" FastLane form.

Concurrently with submission of the pre-proposal, please submit by e-mail to pfc@nsf.gov the following: (1) the title of the pre-proposal, the submitting institution(s), and the name of the PI(s); (2) a list of individuals (and their affiliations) outside the participating institutions whose participation in the review of the pre-proposal might constitute a conflict-of-interest through,

e.g., association with the participants or their institutions; and (3) a list of individuals who might be suitable to serve as impartial reviewers.

In the narrative (item 2 above), provide the following:

- a brief overview of the PFC as a whole, including a concise rationale for establishing the PFC, and an outline of the existing and planned capabilities of the participating institutions in physics research and education (**Limit: 1 page**);
- a description of pertinent achievements under prior NSF support, where applicable (**Limit: 2 pages**);
- a description of each major research component (MRC), including names of faculty-level participants and numbers of undergraduate and graduate students and postdoctoral associates in each group (**Limit: two pages for each major research component**);
- a description of proposed activities in education and human resource development, including the promotion of diversity and outreach; proposed collaborations with industry and/or other sectors; shared experimental facilities; international collaboration (**Limit: 2 pages**);
- and an outline of the proposed arrangements for administration and management of the PFC (**Limit: 2 pages**);

Limit the narrative section as a whole to no more than thirteen pages total, including tables, illustrations, and references, regardless of the number of major research activities.

Note that it is not necessary to complete the rest of the FastLane forms for pre-proposals. If one performs a FastLane “check,” the system will report that not all of the forms have been completed; but the system will nevertheless permit submission of the pre-proposal.

Full Proposal

A full proposal may be submitted only by invitation, based on the evaluation of the pre-proposal. All full proposals must be submitted via NSF FastLane. The proposal must be single spaced in 12-point type and must contain the following items in the order indicated. Proposals that exceed the page limitations will be ineligible for consideration and will be returned without review. Items 2 through 14 described below should be entered in the "Project Description" FastLane form, with the exception of Item 4, which should be entered on the "Add/Modify Non CO-PI Senior Personnel" form.

1. The two-page NSF Cover Sheet. Indicate the total amount requested for the five years of NSF support in the box entitled "requested amount."
2. Table of Contents. Will be generated automatically by FastLane.

3. Executive Summary. Provide a clear rationale for and description of the proposed PFC and its potential impact. Briefly describe the institutional setting of the PFC, its proposed scope and organization, activities in research and education and their integration, development of human resources, any shared experimental facilities, any collaborative activities with industry or other sectors, links with related major research centers on or off campus, and management plan.

Limit: 3 pages.

4. List of Participants. List each senior investigator (faculty level or equivalent), by full name, and his or her institutional and departmental affiliation. Enter in "Add/Modify Non CO-PI Senior Personnel" FastLane form.

5. Achievements Under Prior NSF Support. Describe achievements under prior NSF support that pertain to the present proposal. **Limit: 5 pages.**

6. Major Research Components (MRCs). The PFC may encompass one or more MRCs. For each MRC proposed, provide a concise description of the long-term research goals and intellectual focus, and describe the planned research activities in sufficient detail to enable their scientific merit and significance to be assessed. Describe the role and intellectual contribution of each senior participant in the MRC, and briefly outline the resources available or planned to accomplish the research goals (It will be helpful to underline the name of each senior investigator wherever it occurs.). The need for a center-type approach involving several investigators and the means of achieving this should be clearly established. Place the MRC in the context of the PFC as a whole, and describe interactions with other groups and institutions. At the beginning of each MRC section in the proposal, name the senior personnel who will participate, and state the proposed number of postdoctoral and undergraduate and graduate student participants. **Limit for each MRC: 10 pages, including references.**

7. Education, Human Resources, Diversity, and Outreach. Describe the proposed activities of the PFC in education and human resource development, including plans for participation by undergraduates, pre-college students and teachers, and members of underrepresented groups, as appropriate. Outline plans for seminar series, colloquia, workshops, conferences, summer schools, and related activities, as appropriate. Describe any additional outreach programs not included in other sections of the proposal. Finally, describe means that will be used to measure and/or document the impact of these activities. **Limit: 3 pages.**

8. Shared Experimental Facilities. Describe the shared experimental facilities to be established, including specific major instrumentation, and plans for the development of instrumentation. Describe plans for maintaining and operating the facilities, including staffing, and plans for ensuring access to outside users. Distinguish clearly between existing facilities and those still to be acquired or developed. **Limit: 3 pages.**

9. Collaboration with Other Sectors. Describe any proposed interactions and collaborations with industry, and, where appropriate, with other institutions and sectors, including national laboratories. Define the goals of the collaboration, and describe the planned activities. Describe the roles of the senior participants, the mechanisms planned to stimulate and facilitate knowledge transfer, and the potential long-term impact of the collaborations. **Limit: 3 pages.**

10. International Collaboration. Describe the nature of any planned international collaboration and the expected international and scientific or engineering benefits to the research and education programs. Include a description of the research facilities at the foreign site, as appropriate, and of the division of effort and expertise among the collaborators. **Limit: 1 page.**

11. Seed Funding and Emerging Areas. Through this mechanism, NSF intends to provide flexibility for the PFC to respond quickly and effectively to new opportunities. Briefly describe emerging research plans and related activities, showing clearly how they are related to the mission of the PFC. These may include (but are not limited to): seed support for junior faculty and for investigators changing fields; high-risk research projects; emerging areas of interdisciplinary research; experimental programs to link the university effort in physics with industry and other sectors; the development of tools for remote access to instrumentation; and innovative educational ventures. Seed funding through the PFC is not intended to provide a substitute for NSF individual investigator funding: the criteria and mechanisms for selecting and evaluating projects must be clearly addressed in the management plan. Include the names of key personnel for the first year. **Limit: 3 pages.**

12. Management. Describe the plans for administration of the PFC, including the functions of key personnel and the role of any advisory committee, executive committee, program committee, or their equivalent. Describe the procedures and criteria used to select, administer, and evaluate the Major Research Components and other research programs of the PFC, including seed funding and collaborative programs with other groups and institutions. Plans for administering the shared experimental facilities should be described under item 8. Describe plans for administering the educational programs and outreach activities of the PFC, as appropriate. **Limit: 4 pages.**

13. Institutional and Other Sector Support. Outline institutional and other commitments to the PFC, including cost sharing, space, faculty and staff positions, capital equipment, access to existing facilities, commitments for collaboration and outreach programs, and other commitments. **Limit: 1 page.**

14. Letters of Support. Include only official letters of support verifying specific commitments of resources from participating institutions. Note: scan your signed letters and upload as a PDF file, but do not send originals.

Additional Information

- Biographical Information.

Include a biographical sketch for each senior participant, listing up to ten publications most pertinent to this proposal. **Limit, 1 page for each senior investigator.** Enter in the "Biographical Sketch" FastLane form.

- Current and Pending Support.

List current and pending support for each senior investigator. Enter in the "Current and Pending Support" FastLane form.

- Reviewer Information

Enter the following information into the FastLane "List of Suggested Reviewers" form: (1) a list of individuals (and their affiliations) *outside* the participating institutions whose participation in the review of the full proposal might constitute a conflict-of-interest through association with the participants, and (2) a list of individuals who are suitable to serve as impartial reviewers. Concurrently with the above submission, send an e-mail to pfc@nsf.gov with the above information; include the title of the full proposal, the submitting institution(s), and the name(s) of the PI(s).

PIs are reminded to identify the program announcement number (NSF 00-108) in the program announcement/solicitation block on the proposal Cover Sheet (NSF Form 1207). Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information (Pre-proposals and Full Proposals)

Cost Sharing Requirements

Cost sharing of 15% of the total (five year) requested amount of NSF funds is required and must be shown on line M of the proposal budget (NSF Form 1030).

Documentation of availability of cost sharing must be included in the proposal. The narrative associated with cost sharing should be included in the "Budget Justification" form, which is included as a part of the Budget Form.

Only items that would be allowable under the applicable cost principles, if charged to the project, may be included as the grantee's contribution to cost sharing. Contributions may be made from any non-Federal source, including non-Federal grants or contracts, and may be cash or in-kind (see OMB Circular A-110, Section 23). It should be noted that contributions counted as cost sharing toward projects of another Federal agency may not be counted towards meeting the specific cost-sharing requirements of the NSF award.

All cost-sharing amounts are subject to audit. Failure to provide the level of cost sharing reflected in the approved budget may result in termination of the NSF award, disallowance of costs and/or refund of award funds to NSF.

Budgets

Complete budget pages for each year of support (1 – 5) and a five-year summary budget justification. A five-year budget summary will be automatically generated by FastLane. Provide separate budget pages for the PFC as a whole and for each participating institution.

Also, *in tabular form as follows*, summarize the overall support levels planned for each of the major activities of the PFC as a whole (Note: The Table below should be entered in the "Project Description" FastLane form.)

<i>Summary Table of Requested NSF Support</i>		
Activity	Year 1	5 Year Total
Major Research Comp. (MRC) 1(Title)		
MRC 2 (Title) (repeat for each MRC)		
Shared Experimental Facilities		
Seed Funding and Emerging Areas		
Education and Human Resources		
Outreach		
Administration		
Total		

For each entry in the Table, include indirect costs. Column totals must equal the total budget requested from NSF for the period shown. Include major capital equipment under shared experimental facilities. Support for graduate students should normally be included under research, not under education and human resources.

C. Proposal Due Dates.

Pre-proposals **MUST** be submitted electronically by 5:00 PM, local time, September 18, 2000. Principal Investigators will be notified of the results of pre-proposal review on or about October 30, 2000.

Full proposals **MUST** be submitted electronically by 5:00 PM, local time, January 26, 2001.

D. FastLane Requirements.

Proposers are required to prepare and submit all pre-proposals and proposals for the PFC program through the FastLane system.

Detailed instructions for proposal preparation and submission via FastLane are available at:

<https://www.fastlane.nsf.gov/a1/newstan.htm>.

Submission of Signed Cover Sheets. The signed copy of the proposal Cover Sheet (NSF Form 1207) must be postmarked (or contain a legible proof of mailing date assigned by the carrier) within five working days following proposal submission and be forwarded to the following address:

National Science Foundation
DIS – FastLane Cover Sheet
4201 Wilson Blvd.
Arlington, VA 22230

A full proposal may not be processed until the complete proposal (including signed Cover Sheet) has been received by NSF.

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

Reviews of proposals submitted to NSF are solicited from peers with expertise in the substantive area of the proposed research or education project. These reviewers are selected by Program Officers charged with the oversight of the review process. NSF invites the proposer to suggest at the time of submission, the names of appropriate or inappropriate reviewers. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

Proposals will be reviewed against the following general review criteria established by the National Science Board. Following each criterion are potential considerations that the reviewer may employ in the evaluation. These are suggestions and not all will apply to any given proposal. Each reviewer will be asked to address only those that are relevant to the proposal and for which he/she is qualified to make judgements.

What is the intellectual merit of the proposed activity?

How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?

How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Principal Investigators should address the following elements in their proposal to provide reviewers with the information necessary to respond fully to both of the above-described NSF merit review criteria. NSF staff will give these elements careful consideration in making funding decisions.

Integration of Research and Education

One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities

Broadening opportunities and enabling the participation of all citizens - women and men, underrepresented minorities, and persons with disabilities - is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

In addition to these generic review criteria, reviewers will be asked to use the following criteria. Pre-proposals will be evaluated in terms of their potential to meet the criteria for full proposals.

PFC proposals will be evaluated in terms of the major research components(s) [MRC(s)] and senior investigators, and of the PFC as a whole. Given competing proposals of essentially equal merit, NSF staff will be responsible for ensuring that the overall program reflects an appropriate balance among research topics and among PFCs of differing size and complexity.

Separate Major Research Component and PI Evaluation:

- Intrinsic merit of each MRC: Reviewers will be asked to evaluate the overall quality of the proposed MRCs, and likelihood that the research will lead to significant fundamental advances, new discoveries, and/or technological developments.
- Competence of each senior investigator: Reviewers will be asked to evaluate the merit of each senior investigator and their importance to the PFC goals.

The Center as a Whole:

- Synergy and interconnections within the PFC's major activities: Benefits of a multi-investigator, center-level approach; the synergy among the investigators; and the potential for cross fertilization among major research activities.
- Institutional setting and rationale for the PFC: Relationship to existing and planned institutional programs and capabilities in physics research and education; intellectual breadth of the proposed program; potential for stimulating creative interaction and collaboration. Potential for institutional, national, and international impact.
- Achievements under prior NSF support, where applicable.
- Plans and potential to develop and maintain active collaboration with industry and/or other sectors, where applicable; to stimulate and facilitate knowledge transfer among the institutional participants and between the PFC and other institutions; and to strengthen the links between university-based physics research and its broader impacts. Outreach to other institutions, including international collaboration and cooperation.
- Plans to establish, operate, and maintain shared experimental facilities and to provide appropriate access to users from the home institution and from other institutions.
- Potential effect on the infrastructure of science and engineering, particularly in fostering a broadly interactive approach to cutting-edge research and education, developing effective educational outreach programs, fostering a climate of interaction and effective knowledge transfer between the university and its partners in industry and other sectors (see above), effective use of seed funding, and fostering increased participation in research and education on the part of women and members of underrepresented groups.
- Management plan, and budget. Likely effectiveness of the proposed management plan, including mechanisms for selection of topics and internal allocation of resources, plans for self-evaluation, and plans and potential for maintaining a flexible and innovative program. Appropriateness of the requested budget.

A summary rating and accompanying narrative will be completed and signed by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are mailed to the Principal Investigator(s) by the Program Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

B. Review Protocol and Associated Customer Service Standard

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal.

Pre-proposals will be evaluated by mail and/or panel review.

Reviewers of pre-proposals will be asked to formulate a recommendation to either invite or not invite a full proposal. The PFC program directors will consider the advice of reviewers and will formulate a recommendation. Principal investigators will be notified of the results of the pre-proposal review on or about October 30, 2000.

Full Proposals will be evaluated in two stages of merit review—mail review and presentations at NSF to a review panel. A proposal may be declined at any point in the review process.

Full proposals are reviewed by a number of mail reviewers outside NSF who are experts in the particular field represented by the proposal. The number of reviewers selected is commensurate with the complexity of the proposal. Following the mail review process, finalists will be selected to make oral presentations to a panel at the NSF. Specifics of the review process for full proposals will be transmitted to the PIs when an invitation to submit a full proposal is issued. The PFC program directors will consider the advice of mail and panel reviewers and will formulate a recommendation. Principal investigators will be notified of the results of the full proposal review on or about June 1, 2001.

In all cases, after final programmatic approval has been obtained, award recommendations are then forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant. Proposers are cautioned that only a Grants Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF program officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant signed by the NSF Grants Officer does so at its own risk.

VII. Award Administration Information

A. Notification of the Award

Notification of the award is made *to the submitting organization* by a Grants Officer in the Division of Grants and Agreements (DGA). Organizations whose proposals are declined will be so advised as promptly as possible by the Division of Physics. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator(s).

B. Grant Award Conditions

An NSF grant consists of: (1) the award letter, which includes any special provisions applicable to the grant and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; and (4) the applicable grant conditions, such as Grant General Conditions (NSF

GC-1)* or Federal Demonstration Partnership Phase III (FDP) Terms and Conditions*. Electronic mail notification is the preferred way to transmit NSF grants to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

*These documents may be accessed electronically on NSF's Web site at <http://www.nsf.gov/>. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 or by e-mail from pubs@nsf.gov.

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, (NSF 95-26) available electronically on the NSF Web site. The GPM also is available in paper copy by subscription from the Superintendent of Documents, Government Printing Office, Washington, DC 20402. The GPM may be ordered through the GPO Web site at: <http://www.gpo.gov>.

C. Reporting Requirements

For all multi-year awards (including both standard and continuing grants), the PI must submit an annual project report by FastLane at least 90 days before the end of the current budget period.

Within 90 days after expiration of a grant, the PI also is required to submit a final project report. Approximately 30 days before expiration, NSF will send a notice to remind the PI of the requirement to file the final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

NSF has implemented an electronic project reporting system, available through FastLane. This system permits electronic submission and updating of project reports, including information on: project participants (individual and organizational); activities and findings; publications; and other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system.

D. New Awardee Information

If the submitting organization has never received an NSF award, it is recommended that the organization's appropriate administrative officials become familiar with the policies and procedures in the NSF *Grant Policy Manual* which are applicable to most NSF awards. The "Prospective New Awardee Guide" (NSF 99-78) includes information on: Administration and Management Information; Accounting System Requirements and Auditing Information; and Payments to Organizations with Awards. This information will assist an organization in preparing documents that NSF requires to conduct administrative and financial reviews of an organization. The guide also serves as a means of highlighting the accountability requirements associated with Federal awards. This document is available electronically on NSF's Web site at: <http://www.nsf.gov/cgi-bin/getpub?nsf9978>.

VIII. Contacts for Additional Information

Inquiries about the NSF Physics Frontiers Centers Program should be directed to one of the Division of Physics Program Directors listed below and on the NSF's Web page.

Cognizant Program Directors:

Dr. Denise Caldwell, Atomic, Molecular, Optical, and Plasma Physics, telephone (703) 306-1807, e-mail dcaldwel@nsf.gov

Dr. Alex Firestone, Elementary Particle Physics, telephone (703) 306-1898, e-mail afiresto@nsf.gov

Dr. Marvin Goldberg, Elementary Particle Physics, telephone (703) 306-1894, e-mail mgoldber@nsf.gov

Dr. Richard Isaacson, Gravitational Physics, telephone (703) 306-1899, e-mail isaacson@nsf.gov

Dr. Boris Kayser, Theoretical Physics, telephone (703) 306-1889, e-mail bkayser@nsf.gov

Dr. Brad Keister, Nuclear Physics, telephone (703) 306-1891, e-mail bkeister@nsf.gov

Dr. Gene Loh, Nuclear and Particle Astrophysics, telephone (703) 306-1895, e-mail eloh@nsf.gov

Dr. Terrence Rettig, Multidisciplinary and Education Programs, telephone (703) 306-1809, e-mail trettig@nsf.gov

Dr. Winston Roberts, Theoretical Physics, telephone (703) 306-1805, e-mail wroberts@nsf.gov

Dr. Barry Schneider, Atomic, Molecular, Optical, and Plasma Physics and Theoretical Physics, telephone (703) 306-1808, e-mail bschneid@nsf.gov

For questions related to use of FastLane, contact **Ms. Ramona Winkelbauer** at phyfl@nsf.gov, **703-306-0544**.

IX. Other Programs of Interest

The NSF Guide to Programs is a compilation of funding opportunities for research and education in science, mathematics, and engineering. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Beginning in fiscal year 1999, the NSF Guide to Programs only is available electronically, at <http://www.nsf.gov/cgi-bin/getpub?gp>. Many NSF programs offer announcements concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices listed in Appendix A of the GPG.

Any changes in NSF's fiscal year programs occurring after press time for the Guide to Programs will be announced in the NSF E-Bulletin, available electronically on the NSF Web site at: <http://www.nsf.gov/home/ebulletin/>. Subscribers can also sign up for NSF's Custom News Service to find out what funding opportunities are available.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Grantees are wholly responsible for conducting their project activities and preparing the results for publication. Thus, the Foundation does not assume responsibility for such findings or their interpretation.

NSF welcomes proposals from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities, and persons with disabilities to compete fully in its programs. In accordance with federal statutes, regulations, and NSF policies, no person on grounds of race, color, age, sex, national origin, or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NSF (unless otherwise specified in the eligibility requirements for a particular program).

Facilitation Awards for Scientists and Engineers with Disabilities (FASSED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the program announcement or contact the program coordinator at (703) 306-1636.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation regarding NSF programs, employment, or general information. TDD may be accessed at (703) 306-0090 or through FIRS on 1-800-877-8339.

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the review process; to applicant institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies needing information as part of the review process or in order to coordinate programs; and to another Federal agency, court or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 Federal Register 268 (January 5, 1998). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Reports Clearance Officer; Information Dissemination Branch, DAS; National Science Foundation; Arlington, VA 22230.

OMB No. 3145-0058

CFDA No. 47.049 P.T.34; K.W. 101000